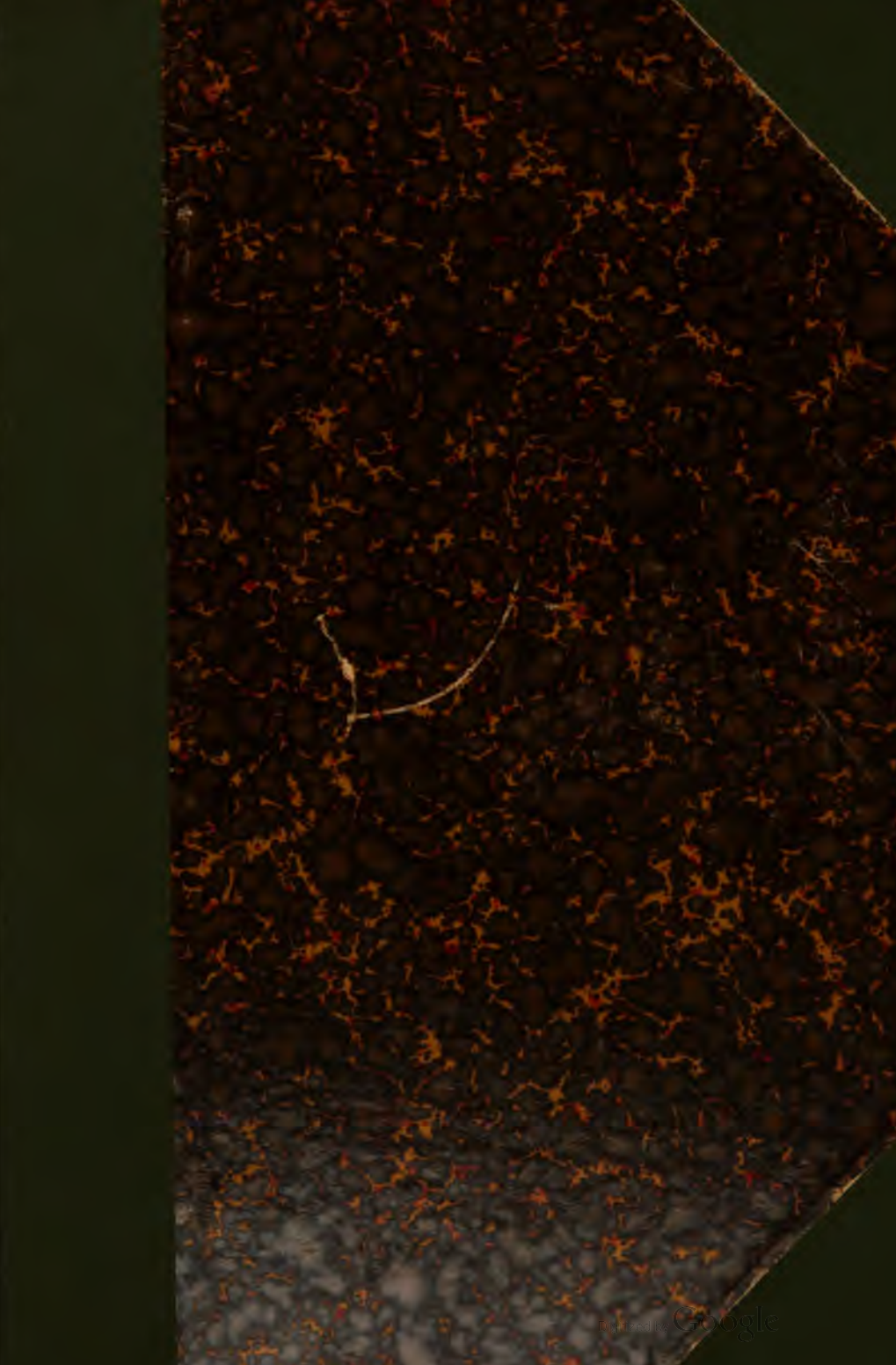

THE BRYOLOGIST

AN ILLUSTRATED BIMONTHLY

DEVOTED TO

NORTH AMERICAN MOSSES

HEPATICS AND LICHENS

VOLUME VIII. 1905

EDITORS
ABEL JOEL GROUT AND ANNIE MORRILL SMITH

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INDEX 1905

SUBJECT INDEX

BOOK REVIEWS

AUTHOR'S INDEX

ERRATA

Page 1, line 13 from bottom, for *Sullivantae* read *Sullivantiae*.

Page 2, line 18 from bottom, for Europeae read Europaea.

Page 3, line 10 from bottom, for Europea read Europaea.

Page 6, line 15, for ONITHOPODIOIDES read ORNITHOPODIOIDES.

Page 7, line 21, for INTEGROFOLIA read INTEGRIFOLIA.

Page 25, line 12, for iodine read iodide

Page 43, line 7 from bottom, for Sphaerocaphalus read Sphaerocephalus.

Page 51, line 22, for saxitalis read saxatilis.

Page 53, line 15, for *endivaefolia* read *endiviaefolia*.

Page 53, line 18, for *Lyelii* read *Lyellii*.

Page 54, line 11, for *leavis* read *lævis*.

Page 57, line 3 of Explanation of Plate V, for *asplenoides* read *asplenioides*.

Page 71, line 2, for **M. C.** read **C. M.**

Page 80, line 10, for **n. sp.** read **nom. nov.**

Page 94, line 8 from bottom, for *cylindrothecium* read *cladorrhizans*.

Page 102, line 8 of key, insert b before Ap. scarlet or orange.

Page 102, last line, for *Everina* read *Evernia*.

Page 103, line 3, for *Everina* read *Evernia*.

Page 103, line 15, for fibrilose read fibrillose.

Page 104, line 18, for filbrillose read fibrillose.

Page 106, line 5, for verraculose read verruculose.

Page 109, line 16 from bottom, for thallus read talus.

Page 112, line 12, for Floerk's read Floerke's.

VOLUME VIII. NUMBER 1

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CONTENTS

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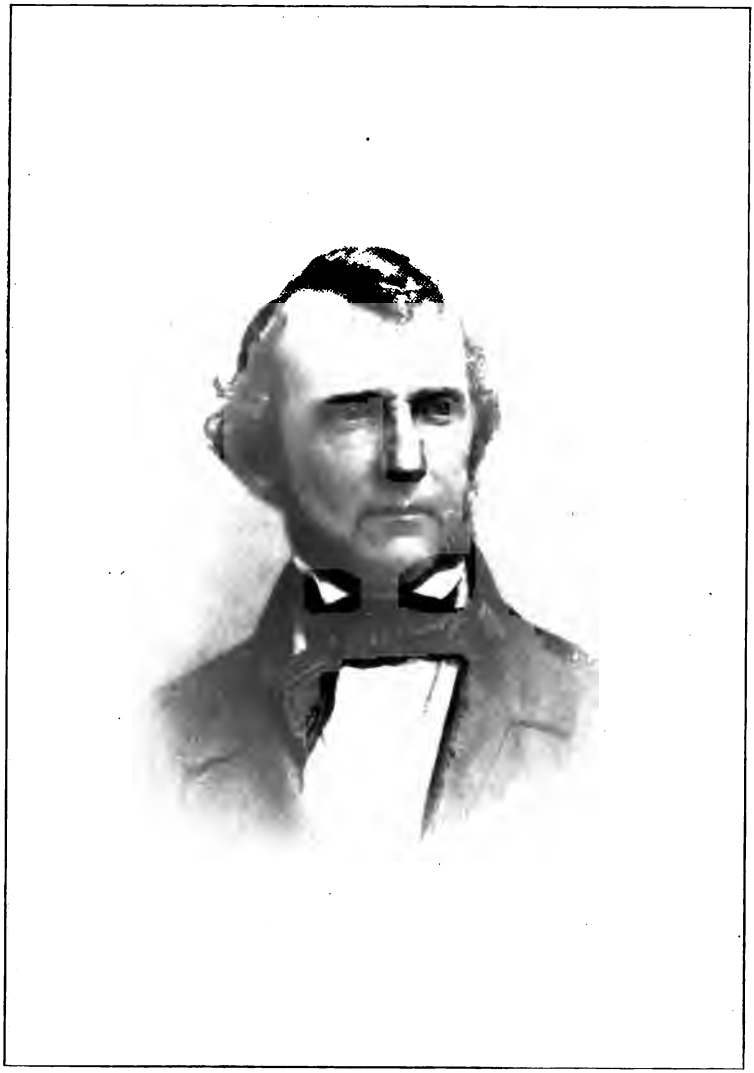

William Starling Sullivant.

THE BRYOLOGIST.

VOL. VIII. JANUARY, 1905. NO. 1.

WILLIAM STARLING SULLIVANT.

January 15, 1803—April 30, 1873.

A Biographical Sketch, adapted from that of Asa Gray, as given in the Supplement of the Icones Muscorum, 1874.

ANNIE MORRILL SMITH.

It is only fitting that the first place in this number of THE BRYOLOGIST should be given to a sketch of the life of the one for whom our Chapter is named, William Starling Sullivant. He was born at the little village of Franklinton, then a frontier settlement in the midst of the primitive forest, near the site of the present city of Columbus, Ohio. His father, a Virginian, and a man of marked character, was appointed by the government to survey the lands of that district of the "Northwest Territory" which became the central part of the now populous State of Ohio; and he early purchased a large tract of land, bordering on the Scioto River, near by, if not including, the locality which afterwards was fixed upon for the State Capitol. William was his oldest son. He received the rudiments of his classical education at the Ohio University at Athens, upon the opening of that institution, after a term in a Kentucky school; was transferred to Yale College where he was graduated in 1823. His father died that year and his services were demanded by the family to care for the estate, which was mainly in lands, mills, etc. To qualify for this he became a surveyor and practical engineer and took an active part in business till the latter part of his life. Mr. Sullivant was thrice married; his first wife was Jane Marshall, of Kentucky. She died within a year after marriage. His second was Eliza G. Wheeler, a lady of rare accomplishments, a zealous and acute bryologist, her husband's efficient associate in all his scientific work until her death of cholera, in 1850 or 1851. Her botanical services are commemorated in *Hypnum Sullivantæ* of Schimper, a moss then new to Ohio. His third wife, Caroline E. Sutton, survived him as well as children, grandchildren and great-grandchildren, all to inherit a stainless and honored name and to cherish a noble memory.

Mr. Sullivant was nearly thirty years old and already married, with his residence established in a suburban home surrounded by a rich flora, before his taste for such studies developed. He collected and carefully studied the plants of central Ohio, and made neat sketches of the minute parts of many of them, especially grasses and sedges, and began his correspondence with the leading botanists of the country, and in 1840 published "A Catalogue of Plants, Native or Naturalized, in the Vicinity of Columbus, Ohio," of sixty-three pages, to which he added a few pages of valuable notes. His only other publication in phanogamous botany is a short article on three new

The November BRYOLOGIST was issued November 1st, 1904.

plants which he discovered in the district, contributed to the American Journal of Science and the Arts, in 1842. His further observations and notes were communicated to friends. As soon as the flowering plants of his district ceased to afford him novelty he turned to the mosses, in which he found abundant scientific occupation of a kind well suited to his bent for patient and close observation, scrupulous accuracy, and nice distinction and discrimination.

His first publication in his chosen department was the "Musci Alleghaniensis," accompanied by the specimens themselves, of Mosses and Hepaticæ collected in a botanical expedition through the Alleghany Mountains from Maryland to Georgia in the summer of 1843, Asa Gray being his companion. In 1846 Mr. Sullivant communicated to the American Academy the first part, and in 1849 the second part of his "Contributions to the Bryology and Hepaticology of North America," which appeared, one in the third, the other in the fourth volume (new series) of the Academy's Memoirs, each with five plates from the author's own admirable drawings. These plates were engraved at his own expense, and were generously given to the Academy. When the second edition of Gray's "Manual of the Botany of the Northern United States" was in preparation, Mr. Sullivant was asked to contribute to it a compendious account of the Musci and Hepaticæ of the region; which he did in the space of about one hundred pages, generously adding at his sole charge eight copper plates crowded with illustrations of the details of the genera, thus enhancing vastly the value of his friend's work and laying a foundation for the general study of bryology in the United States which then and thus began.

So excellent are these illustrations, both in plan and execution, that Schimper, then the leading bryologist of the Old World and a most competent judge since he has published hundreds of figures in his "Bryologia Europeæ," not only adopted the same plan in his Synopsis of the European Mosses but also the very figures themselves (a few of which, however, originally his own), whenever they would serve his purpose, as was the case with most of them. A separate edition was published of this portion of the Manual, under the title of "The Musci and Hepaticæ of the United States, east of the Mississippi River" (New York, 1856, imperial octavo) upon thick paper and with proof impressions directly from the copper plates. This exquisite volume was placed on sale at far less than cost, and copies are now of great rarity and value. It was with regret that the author of the Manual omitted this cryptogamic portion from the ensuing editions and only with the understanding that a separate "Species Muscorum" or Manual for the Mosses of the whole United States should replace it. This most needful work Mr. Sullivant was just about to prepare for the press, when death came to close his career. His work was, however, completed by his friends, Leo Lesquereux and Thomas P. James, and is the Manual of our daily use. For an account of his various Exsiccati reference can be made to the Icones Supplement Sketch by Asa Gray.

The "Icones Muscorum," however, is Mr. Sullivant's crowning work,

as Prof. Gray says, and also the work with which we are most familiar. It consists, as the title indicates, of "Figures and Descriptions of most of those Mosses peculiar to Eastern North America which have not been heretofore figured," and forms an imperial octavo volume with one hundred and twenty-nine copper plates, published in 1864. The letterpress and plates are simply exquisite and wholly unrivalled, and the scientific character is acknowledged to be worthy of the setting. The second volume was in course of preparation at the time of Mr. Sullivant's death, but the material was found to be mostly in notes on herbarium sheets, etc., and the work of editing was undertaken by Leo Lesquereux who alone was in a position to complete it. This was done as a labor of love for his friend, and though pressure was brought to bear to have the name of Leo Lesquereux appear on the title page, he would not consent, and it appears as the final work of Sullivant, though the preface acknowledged this indebtedness to Lesquereux.

In accordance with his wishes all his bryological books and his exceedingly rich and important collections and preparations of mosses were consigned to the Gray Herbarium of Harvard University with a view to their safe keeping and long continued usefulness. The remainder of his botanical library, his choice microscopes, and other collections went to the State Scientific and Agricultural College established at the time of his death at Columbus, and to the Starling Medical College, founded by his uncle and of which he was himself the senior trustee.

Mr. Sullivant was chosen into the American Academy in 1845; received the honorary degree of Doctor of Laws from Gambier College in his native State, was an associate of the principal scientific societies of this country and of several in Europe. His oldest botanical associates long ago enjoyed the pleasure of bestowing the name SULLIVANTIA OHIONIS upon a very rare plant, a Saxifrage, which he himself discovered in his native State on the secluded banks of a tributary of the river which flows by the place where he was born and where his remains now repose.

SPORE DISTRIBUTION IN BUXBAUMIA.

A. J. GROUT.

Mr. Dixon in his Handbook of British Mosses states that *Buxbaumia aphylla* scatters its spores by the rupture of the capsule walls. Schimper in the Bryologia Europea states that the tube of the peristome is so narrow that the spores cannot pass out after the capsule dies and the peristome becomes twisted.

The peristome of Buxbaumia is so perfectly developed that it has not seemed probable to me that it could be a useless organ, and for several years I have been trying to get fresh specimens just at the time of complete maturity and before the spores had been shed. Early last June Mr. Walter Gerritson sent me in some specimens which were in just the right condition and when the capsules were lightly tapped with a pencil the spores were projected as far and as freely as in *Webera sessilis*. After dehiscence the

capsules partially collapse so that undoubtedly some of the spores do escape by the breaking of the capsule walls but that this is the main reliance of the species I do not for a moment believe.

Prof. Goebel says that the breaking of the outer walls of the capsule of *B. indusiata* renders it easier for the raindrops to force out the spores (by reason of the lessened resistance of the capsule wall to the impact of the drops) so that he evidently believes that the peristome of Buxbaumia is functional.

NOTES ON NOMENCLATURE IV.—THE GENUS NECKERA HEDW.

By Elizabeth G. Britton.

There have been three genera named for Noel J. Necker (1729–1793):
Neckeria Scopoli Int. 313. 1777 equals *Capnoides* (Papaveraceæ).
Neckeria Hedw. Fund. **2**:93. 1782 equals *Neckera* Hedw. (Neckeraceæ).
Neckeria Ait. Gmel. Syst. **3**:316. 1791. equals *Pollichia* (Caryophyllaceæ).

The first genus named for him is not in use at present, being antedated by *Capnoides* Adans, but as there are one hundred and ten species in this genus, if it be divided, *Neckeria* of Scopoli would have precedence over *Neckeria* Hedw. Recognizing this fact Mr. S. C. Stuntz published in 1900 a Revision of the North American Species of *Neckera* Hedw., taking up the generic name of *Eleutera* Beauv. (1805). This name is antedated by *Rhystophyllum* Ehrh. (1780–1789) which was founded on *Hypnum crispum* L. (1753), which in turn was based on the descriptions and illustrations given by Dillenius (1741) and Robert Morrison (1699), both of which are unmistakably referable to the genus *Neckera* as at present understood.

As originally founded by Hedwig (1782) his genus *Neckeria* was described simply as having a double peristome, and included *Hypnum crispum*, *curtipendulum*, *viticulosum* and *sericeum* which have been referred to *Neckera*, *Antitrichia*, *Anomodon* and *Homalothecium*. The type species is the same as in *Rhystophyllum*, but that Hedwig did not understand the genus at all in its modern restricted sense is shown by his treatment of *Neckera*, in his Muscorum Frondosorum, ten years later, when he figured nine species which have since been referred by other authors to *Pilotrichella*, *Pilotrichum*, *Pterobryum* and *Cylindrothecium*, including four species of *Neckera*. Furthermore. Hedwig included one species of *Neckera* in his genus *Leskia* (1782) which was also a mixture, including *Pylaisea*. *Anomodon*, *Eurhynchium* and *Leskea*. In fact it will be found that the descriptions given by Morrison and Dillenius, and quoted by Linnaeus, are more lucid and applicable to the genus, than those given by Hedwig, and as Ehrhart's genus *Rhystophyllum* is monotypic, being based on one Linnean species with two illustrations, and founded on a specimen issued in a set of Exsiccatae, there is no question as to his meaning or the application of the name, seeing that its derivation from two Greek words meaning Wrinkled-Leaved, indicates one of the most noticeable characters of the genus as limited in modern times.

It may be of interest to notice the variety of species and genera which have been included under *Neckera* up to 1850 when it was reduced to its natural limits by Schimper. Bridel (1801) described fifteen species, adding some belonging to *Cryphaea* and *Climacium*, to those previously included by Hedwig. In 1819 Bridel divided the genus into two sections, including the species of modern authors in his section *Distichia*, and placing species of *Anomodon* and *Cylindrothecium* under *Neckera*. In the Bryologia Universalis (1827) he added another section to the genus and kept the species of *Neckera* under *Distichia*. Carl Müller took up *Distichia* as a genus and described an African species in 1890.

The genus *Eleutera* was founded by Beauvois (1805) as a substitute for *Neckera* because he did not believe in naming genera after persons so he substituted a name applied to Diana! He listed seven species belonging to *Anomodon*, *Antitrichia* and *Neckera*, of which five had been included in *Neckera* by Hedwig, adding two species of *Cylindrothecium*.

Schimper, in the Bryologia Europæa, 1850, figured and described five species of *Neckera: pennata*, *oligocarpa*, *pumila*, *crispa* and *complanata*, thus bringing the genus into its natural limits, and most subsequent authors have followed him.

But for comprehensiveness and amplification of the genus *Neckera*, Carl Müller exceeded all others, for in 1851, a year after the publication of the fascicle on *Neckera* in the Bryologia Europæa, he described one hundred and fifty-two species with nine sections and thirteen subsections including, according to his own statement, the following genera: *Braunia*, *Hedwigidium*, *Entodon*, *Dichelyma*, *Leucodon*, *Asterodontium*, *Antitrichia*, *Sclerodontium*, *Hedwigia*, *Harrisonia*, *Leptodon*, *Lasia*, *Isothecium*, *Rhystophyllum*, *Climacium*, *Pterigynandrum*, *Leptohymenium*, *Pilotrichum* and parts of *Leskea*, *Hypnum*, and *Fontinalis*. It is one of the subsections, *Cryphæadelphus*, which M. Cardot has recently raised to generic rank to replace *Brachelyma* Sch. If all the old sectional and subsectional names which antedate generic names are to be hunted up there will be no end to the changes and the work necessary to get questions of priority correctly determined!

Jaeger in the Adumbratio (1875–76) recognized one hundred and four species and two sections of the genus, *Paraphysanthus* Spruce, and *Rhystophyllum* Ehrh., and included in the latter five species recognized by Schimper, adding *Menziesii* and *Douglasii*. Paris, in the Index, recognizes one hundred and fifty-eight species of *Neckera*, of which fifty are American and twenty-five are North American and West Indian.

The validity of Ehrhart's genera is being recognized, and Brotherus in the Pflanzenfamilien adopts *Georgia*, *Catharinea*, and *Webera* and relegates to synonymy *Tetraphis*. *Atrichum*, *Webera* Hedw. and *Diphyscium* Ehrh. and we believe that *Rhystophyllum* Ehrh. also has valid claims.

Rhystophyllum Ehrh. Beitr, 149, 1789, Crypt. Exsic. No. 97. 1780.

Neckeria Hedw. Fund. 93. 1782 in part.

Leskea Hedw. Fund. 93. 1782 in part.

Neckera Hedw. Musc. Frond. **3**:48. 1792 in part.
Eleutera Beauv. Prod. 35. 1805 in part.
Neckera Sch. Br. Eu. fasc. 44-45. 1850.
Type species *Hypnum crispum* L. Sp. pl. **2**:1124. 1753.
The following species are at present known in North America:

1. RHYSTOPHYLLUM DOUGLASII (Hook).
   Neckera Douglasii Hooker, Bot. Misc. **1**:131. pl. 35. 1830.
2. RHYSTOPHYLLUM PENNATUM (L.)
   Fontinalis pennata L. Sp. Pl. 1371. 1763.
   Neckera pennata Hedw. Musc. Frond. **3**:47. pl. 19. 1792.
3. RHYSTOPHYLLUM OLIGOCARPUM (Bruch.)
   Neckera oligocarpa Bruch, Mscr. in Hartm. Skand. Fl. 338. 1849.
4. RHYSTOPHYLLUM MENZIESII (Hook.)
   Neckera Menziesii Hook. in Drum. Musc. Bor. Am. (Ed. 1.)
5. RHYSTOPHYLLUM ONITHOPODIOIDES (Scop.)
   Hypnum ornithopodioides Scop. Fl. Carn. 164. 1760.
   Neckera complanata Hub. Muscol. Germ. 576. 1832.
6. RHYSTOPHYLLUM DISTICHUM (Sw.)
   Fontinalis distichum Sw. Pr. Fl. Ind. Occ. 138. 1788.
   Neckera distichum Hedw. Musc. Frond. **3**:53. pl. 22. 1792.
7. RHYSTOPHYLLUM JAMAICENSIS (Gmel.)
   Hypnum Jamaicensis Gmel. L. Syst. Nat. 1341. 1791.
   Neckera undulata Hedw. Musc. Frond. **3**:51. pl. 21. 1792.

BOOK NOTICE—THE TEACHING OF BIOLOGY, BY F. E. LLOYD AND M. A. BIGELOW.

A. J. GROUT.

It is not often that THE BRYOLOGIST feels called upon to review books on other subjects than those to which it professes to devote itself. However, so many of our readers are also teachers that we feel they will thank us for calling their attention to this book which is not merely excellent in theory, but is full of practical hints and suggestions as to material and method.

No teacher of biology or nature study can read this book without being helped. It is almost needless to say that Prof. Lloyd treats of Botany and Prof. Bigelow of Zoölogy.

It is published by Longmans, Green & Co. (in the American Teachers' Series), New York, 8vo., $1.50.

MUSCI BOREALI-AMERICANI BY PROF. J. M. HOLZINGER.

A. J. GROUT.

Fascicle 5, numbers 101-125 of Prof. Holzinger's Musci Acrocarpi Boreali-Americani has just come to hand. Some of the more interesting species are: Mnium glabrescens Kindb., M. venustum Mitt., Bryum coronatum Schwaegr., B. Sawyeri R. & C., B. cirrhatum Hoppe., Orthotrichum pulchellum Brunton and its variety leucodon Vent., Funaria Americana Lindb., Webera proligera (Lindb.) Kindb., Scouleria aquatica Hook., Fissidens rufulus B. & S., and Dicranodontium longirostre (Web. & Mohr.) B. & S.

REVIEW OF DR. WARNSTORF'S PAPER ON EUROPEAN HARPIDIA.

JOHN M. HOLZINGER.

This paper is published in the Beiheft zum Botanischen Centralblatt, Band XIII, Heft 4, 1903. It is accompanied by two plates.

In dealing with the literature of the group the author naturally reviews the work of previous authors who have made it a specialty. Carl Mueller was the first to treat this as a subsection of Hypnum, under the name of *Drepanocladus* (1851). In 1856 Sullivant gave the name *Harpidium* to essentially the same group, with some omissions, and for forty years Sullivant's name has been in use, in spite of the priority of Mueller's name. Since 1885, however, there has been established a genus of lichens, *Harpidium* Körben. So that now a double ground exists for holding to Mueller's older *Drepanocladus*. Limpricht, in his Laubmoose, has reinstated the name, and Warnstorf very properly has taken like ground.

The authors most interested in this group were Schimper (1876), Sanio (1891), Renauld (1890), v. Klingraeff (1893), and Limpricht (1900). The least practical, most mechanical treatment appears to have been that of Sanio. Both Renauld and Limpricht are far more logical in disposing of the multitude of forms in this polymorphic group, A number of species retained by them are however reduced by Warnstorf, and his discussion of these species is quite instructive.

Following is his synopsis of European species of *Drepanocladus*:

I. INTEGROFOLIA—

A. GROUP KNEIFFII:
- D. Kneiffii (Sch.)
- D. polycarpus (Bland).
- D. pseudofluitans (Sanio).
- D. simplicissimus (W. Warnst.)

B. GROUP ADUNCUS:

Crassicostata—
- D. capillifolius (Warnst.)
- D. aduncus (Hedw.)
- D. Sendtneri (Sch.)

Tenuicostata.
- D. lycopodioides (Schwaegr.)
- D. latifolius (Lindb. & Arnell).
- D. brevifolius (Lindb.)
- D. subaduncus (Warnst.)

C. GROUP INTERMEDIUS:
- D. vernicosus (Lindb.)
- D. intermedius (Lindb.)
- D. revolvens (Sw.)
- D. latinervus (Arnell).

II. SERRATIFOLIA—

D. GROUP UNCINATUS:
D. uncinatus (Hedw.)

E. GROUP EXANNULATUS:
D. Rotae (DeNot).
D. pseudorufescens (Warnst.)
D. fluitans (L.)
D. exannulatus (Guemb.)

The author's interruption in this work, in order to elaborate his local Mossflora, has prevented his going into much greater detail and after spreading out his general plan he describes minutely and discusses the range of forms of only the eight species which appear to occur in his restricted area, vis.: *D. pseudofluitans;* D. *simplicissimus*, with three new varieties; *D. capilifolius*, with five varieties, one new; *D. lycopodioides; D. latifolius; D. brevifolius: D. uncinatus*, with eight varieties, one of them new; *D. subaduncus.*

In a foot note under *D. uncinatus plumulosus* the author considers *Hypnum symmetricum* Ren. & Card., a form of this plumulose variety. No other American forms are referred to. While the author does not complete his task in the sense of his first intention, his treatment of this difficult section of Hypnum, based upon a comprehensive study of all the important Harpidium collections of Europe, commands both respectful attention and interest in the sound common sense judgment shown. And one of these days when from among our own bryologists one shall take up our American Harpidia for a general review, the way pointed out by this author will be of the greatest possible value. Winona, Minn.

NEW OR UNRECORDED MOSSES OF NORTH AMERICA.

BY J. CARDOT AND I. THÉRIOT.

Translated and condensed from The Botanical Gazette, May, 1904.

DESCRIPTIONS OF NEW SPECIES GIVEN IN FULL.

PHASCUM HYALINOTRICHUM Card. & Thér.

Plants small, budlike, solitary or clustered, light green. Leaves imbricated, the lower smaller, the upper larger, median and upper ovate, 0.8–1 mm. long by 0.6 mm. wide, concave, entire or subentire, acuminate, margins plane or slightly reflexed below; costa narrow, 24μ wide in the middle of the leaf, attenuate below, excurrent into a hairlike flexuous hyaline point, $\frac{1}{3}$–$\frac{1}{2}$ the length of the leaf. Areolation lax, not papillose not very chlorophyllose, hyaline above, median cells irregular, quadrate, short-rectangular or subhexagonal, 18–30μ by 12–18μ, somewhat incrassate, the lower larger and thinner walled, the upper longer, more incrassate. Seta very short, 0.2 mm. long, geniculate; capsule immersed, globose, apiculate, 0.7 mm. in diameter; calyptra cucullate, covering half the capsule. Ripe spores unknown. Plate XVI.

California: Soldiers' Home, Los Angeles Co. (Dr. Hasse, 1902: herb. C. F. Baker).

A quite peculiar species, very distinct by its habit, which recalls that of an Acaulon, its puliform excurrent nerve, and its loose smooth areolation, a little chlorophyllose below and hyaline above.

PLEURIDIUM BAKERI Card. and Thér.

Plants short, loosely caespitose, yellowish green. Stem 2–4 mm. long, erect, simple. Leaves erect, the lower minute, distant, the upper longer, lanceolate-subulate, acute, entire, rarely subdenticulate at apex, subcanaliculate by the inflexed margins, 1.3 by 0.35 mm.: perichaetial leaves twice as long, gradually subulate; costa broad, 80–100μ, percurrent, somewhat narrower in the perichaetial leaves, lower cells pellucid, subrectangular, 24μ by 12μ, median and upper narrower, 29–30μ by 5μ, opaque, incrassate. Seta erect, short, 0.4 mm. long; capsule immersed, ovate, somewhat gibbous, obtusely apicullate, smooth, orange when mature, 1 mm. by 0.6 mm. Calyptra cucullate, covering $\frac{1}{3}$–$\frac{1}{2}$ the capsule. Spores subglobose, minutely papillose, 24–30μ in diameter. Seemingly dioicous, antheridial buds unknown. Plate XVI.

California: On ground in old pastures, foothills near Stanford University (C. F. Baker, 1902).

VAR. ELONGATUM Card. & Thér.

Differs from the typical form in the longer stems and longer and more flexuous upper leaves.

California: On wet clay soil, foothills near Palo Alto (C. B. Baker, 1902).

Distinguished from *P. subulatum* Br. Eur. by the shorter and less finely subulate leaves, with a broader costa. The later character also separates our species from *P. Bolanderi* C. Muell., which, besides, has the leaves distinctly denticulate on the margins from the middle upward. *P. Ravenelli* Aust., of which we have seen no authentic specimen, according to the description has carinate leaves, excurrent costa, and synoicous inflorescence. If the inflorescence of *P. Bakeri* is, as we think, really dioicous, this character would distinguish it from all the other North American and European species of Pleuridium.

DICRANELLA CURVATA Sch. var. MISSOURICA Card. & Thér.

Differs from the type in the less distinctly striate capsule and the broader and shorter leaf cells.

Missouri: Seligman, on ground (B. F. Bush, 1898).

DICRANUM ALATUM (Barnes) Card. & Thér.

Dicranum Bonjeani DeNot. var. *alatum* Barnes.

Illinois: Chicago (Dr. J. Röll, 1888). Wisconsin: Madison (Cheney and True). W. Minnesota: Cedar Lake, near Montevideo, Chippewa Co. (J. M. Holzinger, 1901).

The nerve bearing on the back two high, serrate lamellæ, and the shorter, thinner-walled cells of the areolation, seem characters of sufficient value to separate this moss from *D. Bonjeani*. Plate XVII.

FISSIDENS BUSHII Card. & Thér.

Fissidens subbasilaris var. *Bushii* Card. & Thér.

Missouri: Eagle Rock, on gravelly ground (B. F. Bush, 1897). Texas: (Elsa Baumann; herb. Dr. Zickendrath).

At first we considered this moss as a variety of *F. subbasilaris* Hedw. but further observations led us to a different conclusion, and now we think it preferable, on account of the monoicous inflorescence and the costa reaching the apex, to place it near *F. taxifolius* Hedw., of which it may be a subspecies, characterized by the nearly twice smaller size, the obtuse abruptly apiculate leaves with the dorsal wing not undulate at base and with smaller cells. From *F. subbasilaris* it is easily distinguished by the inflorescence and the costa reaching the apex. Plate XVII.

FISSIDENS PUSILLUS Wils. var. BREVIFOLIUS Card. & Thér.

Differs from the type in the much shorter and more abruply and shortly acuminate leaves of the sterile innovations.

California: Soldiers' Home, Los Angeles Co. (Dr. Hasse, 1902; herb. C. F. Baker).

POTTIA NEVADENSIS Card. & Thér.

Monoicous? green; caespitose. Stems erect, short, 1-2 mm. long. Leaves erect, ovate, concave, median 1 by 0.6 mm., the lower smaller, all smooth with entire margins somewhat revolute on one side at least. Costa narrow, abruptly excurrent into a subpiliform apex, median cells hexagonal or rhomboidal, not very chlorophyllose, about 18μ by 15μ, the upper somewhat smaller, the basal elongated rectangular 40μ by 18μ, all entirely smooth. Perichaetial leaves much larger and lighter colored, broader, strongly concave, reaching 2 mm. in length. Seta light colored, flexuous, 10–15 mm. long. Capsule 1.5–2 mm. by 0.75 mm., erect, oblong, attenuate at base, truncate at mouth, pale, without peristome. Operculum depressed, long and slenderly beaked, 1.2 mm. long. Columella adhering somewhat. Spores densely papillose, 24–30μ in diameter. Plate XVIII.

Nevada: Kings Cañon, near Carson, on ground about willow thickets (C. F. Baker, 1902).

This species seems very distinct from any other European or North American Pottia.

DIDYMODON TOPHACEUS Jur. var. DECURRENS Card. & Thér.

Similar to var. *elatus*. Leaves remote, recurved when moist, long decurrent, strongly papillose on the back, costa rough.

Texas: Shovel Mt., Burnet Co. (Rev. Franciscus Ebeling; herb. Dr. E. Zickendrath).

DESMATODON BUSHII Card. & Thér.

Plants loosely caespitose, olive-green. Stems erect, .5–15 mm. long simple or divided. Leaves crispate when dry, when moist erect-spreading 1–1.5 mm. by 0.4 mm., oblong-lanceolate, mostly obtuse, costa short-excurrent, mucronate, margins entire, longly revolute, lower cells rectangular, hyaline or somewhat yellowish, 35–40μ by 9μ, the rest roundish-quadrate,

strongly papillose, opaque, 7–8μ in diameter. Costa 60μ thick at base. Perichaetial leaves larger, hyaline in the lower ⅓-½, more narrowly acuminate, margins about as much revolute above. Seta pale red, about 10 mm. long. Capsule erect, subcylindric, with operculum about 2 by 0.44 mm., operculum conic, rather short, .05 mm. long. Calyptra covering ½ the capsule. Peristome 0.35 mm. high, purple, basal membrane short, teeth little twisted, divided to the base into two filiform divisions, papillose, divisions usually united below by two or three trabeculæ. Spores smooth, variable, globose or elliptic, 20–30μ in diameter. Seemingly dioicous (antheridial buds unknown). Plate XVII.

Missouri: Courtney, on wet rocks (B. F. Bush, 1898).

Much resembling *Barbula unguiculata* Hedw. by the habit and the shape and areolation of the leaves, but readily distinguished from it by the peculiar structure of the peristome, which is hardly twisted, and by the spores twice larger. C. Mueller describes a *B. cancellata*, the peristome of which according to the description must have a similar structure to that of our *D. Bushii*, but the teeth are smooth (likely twisted) and the lid is as long as the capsule.

DESMATODON SYSTILIOIDES Ren. & Card.

This is not a *Desmatodon* but a new *Pottia* of the group *Heimii*.

BARBULA MACROTRICHA Card. & Thér.

Tufts compact, hoary above. Stems short, 1–2 mm. long. Leaves erect when moist, appressed into a bud-like shape, twisted when dry, 1–1.5 mm., by 0.6–0.8 mm. ovate or short subspatulate, apex broadly obtuse, often emarginate especially in the lower leaves, broken when old, margins entire, plane at base, above this revolute to near the apex. Costa narrow, 4–8μ thick, excurrent into a smooth hyaline hair which is short in the lower leaves but equalling the rest of the leaf in the upper leaves. Lower leaf cells quadrate or short rectangular, 18μ broad, hyaline or slightly chlorophyllose, nearly smooth, the other cells smaller, about 12μ broad, quadrate or subrotund, strongly chlorophyllose and highly papillose, therefore indistinct. Seta reddish at base, above pale, 6–8 mm. long, Capsule erect, subcylindric, somewhat curved, 2.5 mm. long, including the elongated conic operculum. No mature capsules known. Seemingly dioicous as antherial plants were not seen on fruiting plants. Plate XVIII.

California: Soldier's Home, Los Angeles Co. (Dr. Hasse, 1902; herb. C. F. Baker).

In general appearance resembling the smallest forms of *B. muralis* Timm., from which it differers by the smaller size, the short pedicel, the much shorter leaves obtuse or emarginate and finally eroded at the apex, the hair of the upper leaves as long as or even longer than the lamina, etc.

(To be continued.)

SULLIVANT MOSS CHAPTER ANNUAL REPORTS.

REPORT OF JUDGE OF ELECTIONS.

MISS MARY F. MILLER, December 1, 1904.
Secretary, Sullivant Moss Chapter.

The following report of the election of officers of the Chapter for the year 1905 is respectfully submitted:

For President—Mr. Edward B. Chamberlain 20
" Vice-Pres.—Mrs. Carolyn W. Harris..... 21
" Secretary—Miss Mary F. Miller..... 20
" Treasurer—Mrs. Annie Morrill Smith..... 21

The above candidates are elected.

AGNES CHASE,
Judge of Elections.

REPORT OF THE TREASURER.

The following statement for the year beginning December 1, 1903, and ending December 1, 1904, is respectfully submitted:

RECEIPTS:		DISBURSEMENTS:	
By cash in hand Dec. 1, 1903..	$15 57	To the BRYOLOGIST.....	$96 30
" " to balance from Miss Wheeler.....	1 65	" Express.....	2 85
" " sale of Herbarium Cases.....	1 50	" Postage and Stationery..	9 53
			$108 68
" Dues from Members....	118 88	Cash in hand Dec. 1, 1904...	28 92
	$137 60		$137 60

ANNIE MORRILL SMITH, Treasurer.

REPORT OF THE SECRETARY.

The records of the Sullivant Moss Chapter for 1904 show a gratifying continuance of its usual prosperity. There are now one hundred and thirty-eight members, twenty-two new ones having been added during the year. We have lost five members; four have withdrawn, and I regret to record the death of Mrs. Emilia C. Anthony. Mrs. Anthony always displayed an active interest in bryology, and contributed generously to the Chapter Herbarium.

There are at present nearly one thousand three hundred specimens in the Herbarium of the Moss Department of the Chapter, representing three hundred and eighty-one species and varieties and one hundred and nine genera, one hundred and fifty-nine new specimens and thirty-six new species having been added this year. Among the larger contributions to the Herbarium are over eighty mosses from Florida, North Carolina and Massachusetts, donated by Miss Abby M. Small; and a number of Florida mosses, donated by Mr. Severin Rapp. There have also been valuable con-

tributions from other members. During 1904, seventy-nine specimens of mosses, hepatics and lichens have been offered in the BRYOLOGIST. It is hoped that members will offer more hepatics during the coming year.

A great many mosses have been sent in for determination, and the experts have ever responded cheerfully and willingly to the call for assistance in naming them. Appreciation should also be expressed of the hearty co-operation of the collectors throughout the country, for it is owing to their untiring energy in collecting and distributing specimens that the "offering" department of the Chapter is possible.

Respectfully submitted,

MARY F. MILLER,
Secretary.

OFFERINGS.

(To Chapter Members only. For postage.)

Mrs. R. H. Carter, 37 Church street, Laconia, N. H. *Rhacomitrium aciculare* (L.) Brid., c.fr.; *Rhynchostegium rusciforme* (Neck.) B. & S., c.fr., *Hypnum ochraceum* Turn. st.; *H. palustre* Hedw., c.fr. Collected in Gilford, N. H.

Mr. N. L. T. Nelson, 3968 Laclede Ave., St. Louis, Mo. *Gymnostomum curvirostre* (Ehrh.) Hedw., c.fr.; *Ditrichum pallidum* (Schreb.) Hampe., c.fr. Collected in Missouri.

Mr. Edward B. Chamberlain, 1830 Jefferson Place, Washington, D. C. *Hylocomium proliferum* (L.) Lindb., c.fr. Collected in Maine.

Mr. Severin Rapp, Sanford, Orange Co., Florida. *Leucobryum sediforme* (Müll.) Hedw., c.fr.; *Funaria hygrometrica* (L.) Sibth. var. *lutea*, c.fr. Collected in Sanford.

Mrs. Sarah B. Hadley, South Canterbury, Conn. *Dichelyma capillaceum* B. & S., c.fr,; *Leucobryum glaucum* (L.) Sch., c.fr. Collected in South Canterbury.

Prof. W. W. Stockberger, Bureau Plant Industry, Washington, D. C. *Mnium punctatum* Hedw., c.fr.; *Dicranum viride* Schimp., st. Collected in the White Mountains, N. H.

Mr. Charles C. Plitt, 1706 Hanover street, Baltimore, Md. *Frullania Asagrayana* Mont. Collected near Baltimore.

Mr. G. K. Merrill, 564 Main street, Rockland, Maine. *Cetraria nivalis* Ach. Collected on Mt. Washington, N. H.

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MARCH, 1905

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AN ILLUSTRATED BIMONTHLY DEVOTED TO

NORTH AMERICAN MOSSES

HEPATICS AND LICHENS

EDITORS:

ABEL JOEL GROUT and ANNIE MORRILL SMITH

CONTENTS

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THE BRYOLOGIST.

VOL. VIII. SEPTEMBER, 1905. No. 5.

NOTES UPON MARYLAND BRYOPHYTES AND ON TWO MOSSES FROM VIRGINIA.

EDWARD B. CHAMBERLAIN.

During the past year there have come to me for determination several packages of bryophytes which were collected at Plummer's Island, Maryland. This island is situated in the Potomac river, about nine miles from Washington, D. C., and has been leased by the Washington Biologist's Field Club, which is now engaged upon a preliminary survey of the plant and animal life found thereon. Thus far but little systematic collecting has been made among the mosses and hepatics, and most of the specimens belong to the common species. The following, however, seem to be of sufficient interest to warrant special mention. Only one is reported in the "Guide to the Flora of Washington and Vicinity," by L. F. Ward (1881), which, as far as I know, is the last local flora including the bryophytes of this region.

Specimens of all the species mentioned are in my own herbarium and in that of Mr. E. L. Morris. Eventually, duplicates will be placed in the National Herbarium. I have to thank Dr. A. W. Evans for assistance in determining the Ricciaceae.

Aphanorrhegma serratum Sull. A few patches of this moss were found last fall by Mr. E. L. Morris and myself upon the mud-flats exposed by the low stage of the Potomac river. A small amount was collected also upon the adjacent Maryland shore, and on the Virginia shore opposite.

Ephemerum serratum (Schreb.) Hampe. A few plants of this moss were found intermingled with the *Aphanorrhegma*, at the southern end of the island. Probably the minute size of the plants renders them often overlooked, for, while it is said to be common, it is but rarely reported.

Grimmia campestris Burchell (*G. leucophaea* Grev.). Abundant upon bare ledges, but apparently always sterile. A few miles further up the river, at Great Falls, Maryland, the same species is even more abundant and occasionally fertile.

Thelia Lescurii Sulliv. On sandy ground in dry situations and abundantly fruited.

Riccia crystallina Schwein. This species, together with *R. Sullivantii* Austin, grew upon the wet bare mud of the river bank. Dr. Evans writes that *R. crystallina*, though widely distributed, is but rarely collected in the United States. Both species were in fruit.

Ricciocarpus natans (L.) Corda. The terrestrial form known as *Riccia lutescens* Schwein., grew quite commonly with the *Riccias* mentioned above, being very conspicuous because of its large green crinckled thalli, often more than an inch in diameter. As *Riccia lutescens*, it is reported in Ward's

The July BRYOLOGIST was issued July 15th, 1905.

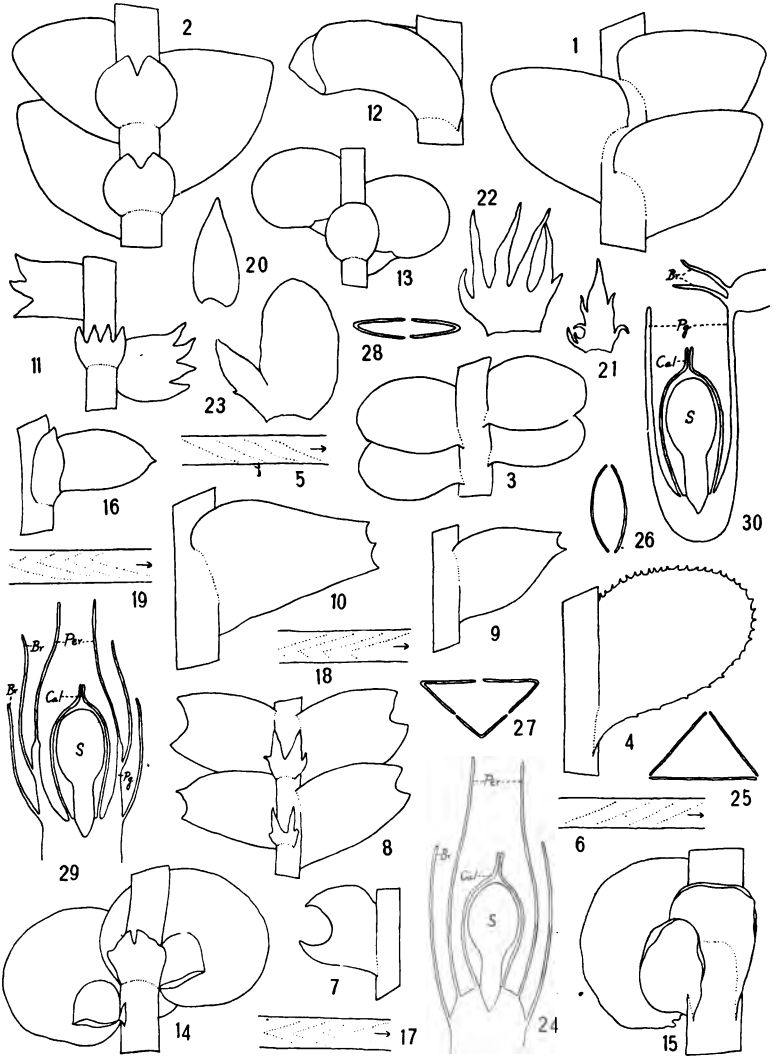


PLATE V.—*Jungermanniaceæ.*

THE BRYOLOGIST.

VOL. VIII. JULY, 1905. No. 4.

DIAGNOSTIC CHARACTERS IN THE JUNGERMANNIACEAE.

ALEXANDER W. EVANS.

[Read at the meeting of the Sullivant Moss Chapter at Philadelphia, Pa., Dec. 31, 1904.]

If one were asked to describe in a few words the general characteristics of the mosses the task would be comparatively easy, at least so far as the gametophyte is concerned. Throughout the entire group this consists of a leafy stem, and the leaves although exhibiting considerable diversity in form, in texture and in the peculiarities of the margin, are never deeply

EXPLANATION OF PLATE V.

Fig. 1. *Kantia Trichomanis*, from above. Fig. 2. The same, from below. Fig. 3. *Odontoschisma prostratum*, from above. Fig. 4. *Plagiochila asplenoides*, from above. Fig. 5. Diagram to illustrate the attachment of succubous leaves, the dotted lines representing the lines of attachment and the arrow the direction of growth. Fig. 6. Diagram to represent the attachment of incubous leaves. Fig. 7. *Cephalozia connivens*, from above. Fig. 8. *Lophocolea bidentata*, from below. Fig. 9. *Kantia Sullivantii*, from above Fig. 10. *Bazzania trilobata*, from above. Fig. 11. *Lepidozia reptans*, from below. Fig. 12. *Marsupella emarginata*, from above. Fig. 13. *Archilejeunea clypeata*, from below. Fig. 14. *Frullania Brittoniae*, from below. Fig. 15. *Porella platyphylla*, from below. Fig. 16. *Diplophylleia apiculata*, from above. Fig. 17. Diagram to illustrate the attachment of complicate leaves which are neither incubous nor succubous. Fig. 18. Diagram to illustrate the attachment of complicate and incubous leaves. Fig. 19. Diagram to illustrate the attachment of complicate and succubous leaves. Fig. 20. *Harpanthus scutatus*, underleaf. Fig. 21. *Lophozia barbata*, underleaf (after Warnstorf); bifid underleaves also occur in this species. Fig. 22. *Cephalozia connivens*, bract. Fig. 23 *Frullania Brittoniae*, bract. Fig 24. Diagram representing a radial section through an archegonial branch and young sporophyte in the genus *Lophocolea*: *S.* sporophyte; *Cal.* calyptra; *Per.* perianth; *Br.* bract. Fig. 25. Diagram representing a cross-section of the perianth in the same genus, *i. e.*, an epigonianthous perianth. Fig. 26. Diagram representing a cross-section of the perianth in the genus *Plagiochila*. Fig. 27. Diagram representing a cross-section of the perianth in the genus *Cephalozia*, *i. e.* a hypogonianthous perianth. Fig. 28. Diagram representing a cross-section of the perianth in the genus *Scapania*. Fig. 29. Diagram representing a radial section through an archegonial branch and young sporophyte in the genus *Marsupella*: *Pg.* perigynium; other references as in Fig. 24. Fig. 30. Diagram representing a radial section through the pendent perigynium and young sporophyte in the genus *Kantia*.

The May BRYOLOGIST was issued May 1st, 1905.

lobed or cleft and never show very marked differences in the various parts of the plant, even when the stem and its branches are prostrate and closely adherent to the substratum.

With the Hepaticae, on the other hand, the task would be much more difficult. The gametophyte here exhibits the greatest variety in different families. It is sometimes a flat thallus without any indication of leaves, sometimes a thallus-like stem with rudimentary leaves, sometimes a more or less cylindrical stem with distinct leaves; and these various types are connected by intermediate conditions. In the thallose forms the cell-structure is sometimes uniform throughout or nearly so, and sometimes shows a high degree of differentiation; here again there are intermediate conditions. Both thallose and leafy species are almost always prostrate and show marked differences between the upper and lower portions. In other words they are "dorsi-ventral." In the thallose forms the dorsiventrality manifests itself in differences in cell-structure; in the leafy forms in differences between the leaves.

In the eastern United States nearly three fourths of our Hepaticae are leafy and belong to the family Jungermanniaceae, sometimes spoken of as the "scale-mosses," and we will confine our attention to these. The scale-mosses may usually be distinguished at a glance from the true mosses by the prostrate habit to which allusion has just been made and by the fact that this habit usually brings about a distinctly flattened appearance for the whole plant, the leaves themselves as well as the stem being more or less appressed to the substratum. When we examine a plant carefully we find that the leaves are more regularly arranged than in most of the mosses; looking at a stem from above (*Fig. 1*) we see two distinct longitudinal ranks of leaves spreading out on either side; looking at the same stem from below (*Fig. 2*) we can usually see a third rank of leaves, which are more or less appressed to the stem. The leaves in fact are in a spiral and conform to the one third arrangement. It will be seen at a glance that the leaves are not all exposed to the same external conditions. Those, for example, in the two ranks which we saw from above, are turned toward the light, and are, therefore, well placed for carrying on photosynthesis; those in the third rank, however, are practically cut off from the light. Probably this difference in environment has been a potent factor in bringing about a diversity in the leaves, those in the third rank being different in form and usually much smaller than the others. For the sake of convenience in description, the leaves of the third rank are spoken of as "underleaves" while those of the other two ranks are called "side-leaves" or simply "leaves." In certain of our species the underleaves are so small that they can be demonstrated only by careful dissection; in a few species they are absent altogether. Even in the last case, however, the leaves are closer together on the upper surface of the stem than on the lower, so that they do not conform to the one half arrangement, which we would naturally expect with only two longitudinal ranks of leaves.

The leaves exhibit a much greater diversity of form than the underleaves, and this manifests itself in pecularities of the margin, in lobing or

division, in folding, and in the development of remarkable structures known as water-sacs. The simplest type of leaf is that which is undivided, although this is probably not the most primitive type. In this case the leaf varies in form from ovate to broadly rotund, and in all our northern genera is rounded or bluntly pointed at the apex (*Figs. 1-3*). The margin is commonly entire but is more or less toothed in certain species of *Plagiochila* (*Fig. 4*). The leaves here and throughout the group are sessile just as in the mosses, but the line of attachment instead of being transverse is usually oblique; sometimes the forward or apical end of this line is turned toward the substratum and sometimes away from it, these conditions being best shown by such diagrams as *Figs. 5* and *6*, the arrows indicating the direction of growth. These differences in the attachment of the leaves bring about differences in the way in which they overlap each other and are of the utmost importance in distinguishing certain genera. The condition seen in *Fig. 5* is known as succubous and is found in the common genera *Jungermannia*, *Nardia*, *Chiloscyphus*, *Plagiochila* (*Fig. 4*) and *Odontoschisma* (*Fig. 3*). The other condition is called incubous (*Fig. 6*), and is found in the common *Kantia Trichomanis* (*Figs. 1, 2*). The distinction between succubous and incubous leaves applies not only to species with undivided leaves but also to many of those with variously lobed or divided leaves.

Among lobed or divided leaves the simplest condition is found where only two apical teeth or lobes are present; sometimes the teeth are very minute and only one or two cells long; in other cases the divisions extend to the middle of the leaf or beyond. Among species with succubous leaves the bidentate or bilobed condition is found in the genus *Cephalozia* (*Fig. 7*), and in many species of *Lophocolea* (*Fig. 8*) and *Lophozia*; it is much rarer in species with incubous leaves but is clearly shown by *Kantia Sullivantii* (*Fig. 9*). In *Lophocolea heterophylla* the leaves show all gradations between the deeply bilobed and undivided conditions.

Tridentate and trifid leaves, quadridentate and quadrifid leaves are also found among the Hepaticae; none of our northern species, however, show a larger number of primary lobes than four. In the genus *Bazzania* the leaves are incubous, and in our commonest species, *B. trilobata* (*Fig. 10*), have three apical teeth. In *Lepidozia reptans* (*Fig. 11*), also with incubous leaves, the same stem will often produce both trifid and quadrifid leaves; the same is true of the succubous leaved *Lophozia barbata* and of other species of this genus. Here again gradations between bifid leaves and those just considered are also to be observed.

All of the leaves which we have so far noted are more or less flattened in one plane, The form of the leaves, however, is much more difficult to understand when the lobing is accompanied by folding. This condition is described as "complicate," the fold being called the "keel." We find it most frequently among bilobed leaves, which are then described as "complicate-bilobed." In these leaves the method of attachment is entirely different from what we have described above, each lobe being attached independently to the stem and the two lines of attachment meeting at an angle, which is sometimes very sharp. In the genus *Marsupella* (*Fig. 12*),

and in certain species of *Scapania* and *Sphenolobus*, the lobes are approximately equal in size, and the leaves ought not to be described as either incubous or succubous. In the majority of cases, however, where the complicate condition occurs, the lobes are unequal in size, the dorsal lobe being the larger in certain species and the ventral in others. In the Lejeuneae (*Fig. 13*), in *Frullania* (*Fig. 14*), *Radula* and *Porella* (*Fig. 15*), the dorsal lobe is the larger and the leaves are described as incubous: in many species of *Scapania* and in *Diplophylleia* (*Fig. 16*) the ventral lobe is the larger and the leaves are described as succubous. These conditions may also be best seen by diagrams (*Figs. 17–19*). In the genus *Ptilidium* the leaves are normally quadrifid and at the same time complicate, the keel occurring between the two middle divisions. In *Pt. ciliare*, which is one of the commonest and most conspicuous species in the eastern United States, the leaves are beautifully fringed on the margin; and this condition is carried to an extreme in the still more beautiful *Trichocolea tomentella*, where the leaves present the appearance of being divided almost to the base into an innumerable number of delicate hairs.

The leaves in many of the Hepaticae, through their arrangement, overlapping, lobing and folding, doubtless assist the plant materially in absorbing and retaining water. This is seen especially well in the two species just described, where the whole plant is practically permeated in all directions by capillary spaces, which can take up and hold water like a sponge. In certain genera this function is assumed by a definite part of the leaf, which becomes hollowed out and is know as the "water-sac." Among our northern genera this structure is best studied in *Radula*, in the Lejeuneae (*Fig. 13*), and in *Frullania* (*Fig. 14*), all of which, as noted above, are characterized by complicate-bilobed leaves, the dorsal lobe being the larger. In all these forms the water-sac is formed wholly or in part by the ventral lobe or, as it is often called, the "lobule," to distinguish it from the dorsal division of the leaf, called simply the "lobe." In *Radula* and in the Lejeuneae, the free edge of the lobule is closely appressed to the lobe except in the outer part, and the region of the leaf near the keel becomes inflated and acts as the sac, the water gaining entrance through the minute opening in the outer part where lobe and lobule are not in contact. In these cases both lobe and lobule enter into the formation of the water-sac. In *Frullania* a part of the lobule itself becomes hollowed out into a hood-like organ, open at one end and blind at the other; here the entire sac is formed by the lobule.

In comparison with the leaves the underleaves exhibit much less variety, as has already been noted. They are almost invariably transversely attached to the stem, the line of attachment being straight or nearly so; sometimes, however, they are decurrent, and the line of attachment becomes more or less arched. The latter condition is well seen in *Porella* (*Fig. 15*), where the decurrent base of the underleaf is sometimes longer than the free portion. Here again, as in the leaves, the simplest type is undivided, but the apex although sometimes broad and rounded as in *Archilejeunea clypeata* (*Fig. 13*), and in *Porella* (*Fig. 15*), is usually sharply pointed, the underleaf itself assuming a lanceolate or subulate form. These pointed

underleaves are very well seen in *Harpanthus* (*Fig. 20*), where they attain an appreciable size, but they are also to be found in many other species. They become more complicated when their margins are irregularly toothed or ciliate, as in many species of *Lophozia* (*Fig. 21*).

Variously lobed and divided underleaves are characteristic of many genera. In *Frullania* (*Fig. 14*) and in *Lejeunea* the underleaves, which are subrotund in form, are bifid, sometimes to beyond the middle. In *Lophocolea* (*Fig. 8*), *Chiloscyphus*, *Geocalyx* and other genera, the underleaves are much narrower, but are also deeply bifid. In *Lepidozia* (*Fig. 11*) the underleaves are broad and deeply trifid or quadrifid in the larger species. In *Ptilidium ciliare* and in *Trichocolea* the underleaves resemble the leaves in being strongly ciliate along the margins of the divisions. In none of our northern species, however, do the underleaves produce water-sacs, although this phenomenon occurs among certain antarctic genera.

It will be seen from what has been said so far that the leaves and underleaves afford generic characters of much importance. These are supplemented, in the purely vegetative part of the plant, by characters derived from the branching and from the cell-structure; but, as it is difficult to discuss these without entering into considerable detail, we may pass at once to characters connected with the reproduction.

The antheridia and archegonia of the scale-mosses are essentially like those of the true mosses. The archegonia are borne singly or in groups on the tips of specialized branches, the growth of which is thereby terminated. As a rule only one archegonium of a cluster develops a sporophyte. Even in the absence of fertilization, the archegonial branches yield important characters. Instead of being prostrate such branches tend to be ascending or erect, and their leaves are oftentimes very different in appearance from the ordinary vegetative leaves. These leaves are called "bracts," and the corresponding underleaves "bracteoles." In many cases the latter are nearly or quite as large as the bracts, and this is true of some species which lack underleaves on ordinary stems. In a number of species which are destitute of underleaves, bracteoles also fail to be devoloped. The various species of *Radula* are striking examples of this condition. As a rule the bracts are less highly specialized or less definite in their characters than the leaves. In a species with bifid leaves, for example, the bracts tend to be irregularly two-to four-lobed (*Fig. 22*); in a species with well-developed water-sacs these structures are not developed on the bracts (*Fig. 23*); in certain species with undivided leaves, the bracts are bifid. In still other cases the bracts are scarcely to be distinguished from the leaves. Usually the archegonial branch shows a gradation between typical leaves and typical bracts.

The archegonia, the young sporophyte and the calyptra cannot be seen as a rule without careful dissection. This is because they are covered over and concealed by other parts of the plant, and are apparently thus protected from being dried up. In very rare cases, the covering is done by the bracts alone. Usually, however, in addition to the bracts, the archegonial branch bears a remarkable tubular organ called a "perianth," or else itself develops into a hollow structure known as a "perigynium."

The perianth is an organ peculiar to the scale-mosses, although not found in all of them. In the majority of our species it develops whether fertilization takes place or not; in a few species, however, its development depends upon fertilization. In no case does the development of the perianth precede that of the archegonia. The perianth consists of a hollow tube, which is attached at the base and open at the tip, sometimes with a wide mouth. Under normal circumstances it surrounds the young sporophyte and assists the calyptra in protecting it (*Fig. 24*). Most writers look upon the perianth as a structure formed by the coalescence of leaf-like organs, and it differs in appearance according to the number and character of the leaves which enter into its formation. In the simplest case it is formed by the union of two leaves and one underleaf, which remain flat. This gives rise to a perianth in the form of a triangular prism, three angles or keels being formed by the united edges of the leaves. If we suppose that such a perianth is pressed back against the substratum, two of the keels will be lateral and the third will be dorsal. This type, which is known as "epigonianthous," is beautifully shown in the genus *Lophocolea*, and may be represented in cross-section by such a diagram as *Fig. 25*. In case no underleaf takes part in the formation of the perianth, we observe a structure which is compressed at right angles to the substratum, a condition found throughout the large genus *Plagiochila* (*Fig. 26*). A very different type of perianth arises when the leaves which enter into its formation are complicate instead of being flat. In this case the keels of the leaves usually form keels on the perianth, and when a triangular perianth is formed, the third keel instead of being dorsal will be ventral. This condition, called "hypogonianthous," is found with certain modifications in a large number of genera, of which *Frullania*, *Lejeunea*, *Porella*, *Cephalozia*, *Bazzania* and *Lepidozia* may be especially mentioned (*Fig. 27*). When no underleaf takes part in this type of perianth, we again observe a compressed structure, but this time the flattening is parallel to the substratum instead of at right angles to it (*Fig. 28*). This condition is found in the genera *Radula* and *Scapania*. In many species the structure of the perianth is obscured, either by the obliteration of keels or by the interpolation of additional keels, and under these circumstances the interpretation becomes much more difficult.

The perigynium, unlike the perianth, is formed directly from the archegonial branch. It occurs in comparatively few genera, and its development is always dependent upon fertilization. While the sporophyte is growing, the archegonial branch which bears it begins to grow also in the form of a hollow tube. This encloses the young sporophyte and carries up on the outside the bracts and bracteoles. In some cases, as in *Nardia* and *Marsupella*, the perigynium bears a perianth at its mouth (*Fig. 29*). In other cases, as in *Gymnomitrium*, there is no perianth formed. In the examples so far considered the perigynium has grown in an upward direction only; in other cases, however, it grows downward as well, and sometimes its growth is entirely downward. The first of these conditions may be seen especially well in *Nardia haematosticta*, the second in *Geocalyx* and *Kantia*, the perigynium in these two genera being in the form of a pendent sac (*Fig. 30*),

which penetrates into the substratum and thereby protects the sporophyte still more effectively. With this type of perigynium the perianth is almost invariably absent.

The characters noted above are usually sufficient to distinguish the genera of the Jungermanniaceae. The antheridial branches and the sporophytes occasionally yield additional characters of interest. Both of these structures, however, are likely to be uniform or nearly so throughout large groups of genera, and their characters, therefore, are more frequently tribal or even ordinal in value rather than generic. Under the circumstances it is hardly necessary to discuss them at the present time. YALE UNIVERSITY.

ADDITIONS TO THE BRYOPHYTIC FLORA OF WEST VIRGINIA.

A. LEROY ANDREWS.

The "Preliminary Catalogue of the Flora of West Virginia," published by Dr. C. F. Millspaugh in 1892 (W.Va. Exp. Stat. Bull. No. 24, pp. 311-537), contained a list of eighty-three species and varieties of mosses and twenty-seven of hepatics, collected at a few points, mostly in the vicinity of Morgantown, in Monongalia County. A flora of the state embodying the results of later collections was published by Dr. Millspaugh in collaboration with Mr. L. W. Nuttall, who had made extensive collections and studies about Nuttallburg, in Fayette County (Publications Columbian Field Museum, Bot. Series, Vol. 1, pp. 65-276, 1896). In this list were noted six additional species of mosses and five of hepaticae. For both lists, as is explained in the introduction to the latter, the bryophytes had been gathered spasmodically and incidentally to the investigation of other plants.

I have seen two papers of later date listing additions to the West Virginia flora, viz.: "Some Plants of West Virginia," by E. L. Morris (Proc. Biol. Soc. Wash., Vol. XIII., pp. 171-182, 1900), and "Some New and Additional Records in Flora of West Virginia," by C. L. Pollard and W. R. Maxon (Proc. Biol. Soc. Wash., Vol. XIV., pp. 161-163, 1901). Of these the former mentions two additional hepaticae and four mosses, two of which are included in the previous lists. The latter includes as new, two hepatics and seven mosses, one a repetition from the preceding paper.

From collections made mostly during the fall of 1903 and spring of 1904 in the vicinity of Morgantown I am able to add the following. Those recorded from near Masontown are from Preston County; the others, unless expressly stated, from Monongalia County. The region of Chestnut Ridge was most productive in bryophytes, the territory westward being very poor in species. Chestnut Ridge enters West Virginia from Pennsylvania, its direction slightly southwesterly, its altitude approximately 2,000 feet, and represents, so far as Pennsylvania and northern West Virginia are concerned, the extreme western ridge of the Allegheny system. East of Morgantown this ridge is cut by the valleys of Decker's Creek and the Cheat River, and the richest collecting grounds are along the mountain streams tributary to these rivers. Especially are the steams descending the western side of the ridge characterized by rapid falls and the presence in their beds of many

large sandstone bowlders, covered commonly with a luxuriant growth of hepatics. Tibbs Run, which joins Decker's Creek at Dellslow, was explored by Dr. Millspaugh. Quarry Run, a mountain tributary of Cheat River, proved of no less interest, duplicating in the main the species of the other, even to the presence of the uncommon hepatic *Herberta adunca* (Dicks.) S. F. Gray.

The species not previously observed are the following:

MUSCI.

Sphagnum quinquefarium (Braith.) Warnst. Blister Swamp, Randolph Co. (A. H. Moore, Sept., 1904).

Sphagnum cymbifolium Ehrb., var., *squarrosulum* Bryol. Germ. Specimens observed by Tibbs Run as well as Dr. Millspaugh's from the same locality preserved in the Experiment Station herbarium show strongly marked the varietal characters. Typical forms of *S. cymbifolium* occurred at another point in the valley of Decker's Creek, and I have a specimen collected by Mr. A. H. Moore in Blister Swamp, Randolph Co.

Andreæa rupestris Hedw. Rocks at summit of Ridge, Cheat View.

Pleuridium alternifolium Brid. Ground on Dorsey's Knob, near Morgantown.

Dicranella rufescens (Turn.) Schp. Bank by road, valley of Decker's Creek, near Lick Run.

Dicranella varia (Hedw.) Schp. Near road, in the vicinity of Easton.

Dicranum montanum Hedw. Decayed spot in tree, near Dellslow.

Dicranum viride (S. & L.) Lindb. From fallen tree, near Quarry Run

Grimmia apocarpa (L.) Hedw. Rocks in brook, Tibbs Run.

Rhacomitrium aciculare (L.) Brid. Tibbs Run.

Hedwigia ciliata Ehrh., var. *secunda* Schp. Rocks in Tibbs Run. Nicely fruited specimens on boulders near Dry Run. The varietal characters strongly marked.

Drummondia clavellata Hook. Tree, near Easton.

Ulota Hutchinsiæ (Sm.) Schp. Rocks in Tibbs Run.

Webera proligera (Lindb.) Kindb. With *Dicranella rufescens*, near Lick Run. Not fruited.

Bryum capillare L. Quarry Run.

Bryum caespiticium L. Near Dry Run.

Mnium affine Bland. Dry Run.

Fontinalis Dalecarlica Bryol. Eur. By Tibbs Run. Not fruited.

Hookeria Sullivantii C. M. This species was collected at a few points in Tibbs Run. No fruit was in evidence, but the leaves bore regularly at the tips a number of clavate gemmae.

Thamnium Allegheniense (C. M.) Bryol. Eur. By Tibbs Run.

Leskea obscura Hedw. Base of tree, near Morgantown.

Anomodon obtusifolius Br. & Sch. Base of tree, by Decker's Creek, near Morgantown.

Leptodon trichomitrion (Hedw.) Mohr. Tree near Cheat River, at Ices Ferry. Also near Masontown:

Thuidium scitum (Beauv.) Aust. Rocks by Tibbs Run.

Climacium Americanum Brid., var, *Kindbergii* R. & C. "Glades" near Masontown. The swampy glades furnish an environment quite similar to that of the New England coastal region, where this form flourishes.

Pylaisia intricata (Hedw.) Byrol. Eur. Trees, near Cheat River and Decker's Creek. Probably less common here than *P. velutina*, which was noted by Dr. Millspaugh.

Brachythecium luteum (Brid.) Bryol. Eur. Ground near Quarry Run. Specimens of this species were also collected further north on Chestnut Ridge, near Mt. Pleasant, Pa.

Brachythecium rivulare (Bruch.) Byrol. Eur. Ground near Quarry Run.

Rhyncostegium serrulatum (Hedw.) Jaeg. Ground about Morgantown. This is a common species of Chestnut Ridge, near Mt. Pleasant, Pa.

Rhapidostegium cylindrocarpum (C. M.) Kindb. Decayed wood, near Quarry Run.

Hypum reptile Rich. Ground near Tibbs Run.

Hypnum uncinatum Hedw. Quarry Run.

Hylocomium brevirostrum (Ehrh.) Bryol. Eur. Not uncommon in deep brook ravines, Tibbs and Quarry Run. Fruiting at latter. Beautifully fruiting in gorge of Cucumber Falls, at Ohiopyle, Pa.

HEPATICAE.

Cephalozia serriflora Lindb. Rotton wood, near Tibbs Run. This is possibly the same as *C. Virginiana* reported by Pollard and Maxon (Sc. A. W. Evans, in Rhodora, Vol. VI., pp. 173-174).

Frullania Brittoniae Evans. Trees near Cheat River, by Ices Ferry. Also near Masontown.

Frullania Eboracensis Gottsche. Trees by Decker's Creek, near Morgantown.

Frullania squaraosa (R. Bl. & N.) Dumort. Same locality as last.

Jungermannia lanceolata L. Rocks, in Tibbs Run.

Lejeunea cavifolia (Ehrh.) Lindb. A small form growing on rocks in Tibbs Run is referred by Dr. Evans to this species.

Lepidozia sylvatica Evans (Sc. Rhodora, Vol. VI., pp. 186-189). Ground near Tibbs Run.

Lophocolea bidentata (L.) Dumort. Rocks with mosses, by Quarry Run.

Lophozia Marchica (Nees.) Steph. Specimens from wet place by road, near Easton, are so named by Dr. Evans.

Nardia crenulata (Smith) Lindb. Springy place, near Easton.

Nardia crenuliformis (Aust.) Lindb. Few specimens from rocks in Tibbs Run.

Odontoschisma denudatum (Mart.) Dumort. Decaying stumps and logs by Tibbs Run.

Odontoschisma prostratum (Swartz.) Trevis. Rocks beside Tibbs Run. *O. Spagni* listed by Millspaugh and Nuttall is evidently referrable to one or the other of these species. (Sc. Evans on Odontoschisma, Bot. Gaz., Vol. XXXVI., pp. 321, 348).

Plagiochila Sullivantii Gottsche. Earth in vicinity of Quarry Run.

Sphenobolus Michauxii (Web.) Steph. Vertical rocks at Cheat View.

Hanover, N. H.

MUSCI ARCHIPELAGI INDICI.

(Prepared and Distributed by Max Fleischer.)

The seventh series of these very interesting mosses have been recently received, including numbers 300–350. They are accompanied by a printed index and each label bears the date of issue as well as of collection! They include mosses from Java, West Java and Ceylon, with a few from Borneo, Malacca and Singapore. The specimens are abundant and well prepared, the labels models of typography. Of one rare species, *Ephemeropsis Tjibodensis*, large leaves, covered with this species have been distributed. Many of the genera are familiar, but the species are almost all different. There are some new species and many new combinations in these exsiccatæ.

New York Botanical Garden. E. G. Britton.

A CORRECTION.

Hypnum eugyrium var. *viridimontanum*, published in the May Bryologist, appears to be *Raphidostegium Marylandicum* (C. M.) J. & S. This was discovered some time before The Bryologist was printed, but through a misunderstanding was not corrected. A. J. G.

LICHENOLOGY FOR BEGINNERS—II.

Frederick LeRoy Sargent.

(Begun in May 1905, issue.)

Among the first specimens a student is likely to collect there will almost surely be found examples of the species known as *Parmelia conspersa*, which grows most plentifully on stone walls and rocks in pasture land. Its general form is shown in Fig 1. The upper surface is pale greenish or straw color, becoming darkened with age; the under surface is dark brown or black. Upon the upper side there are almost always to be found a number of chestnut-colored saucer-shaped fruits. This *Parmelia* will answer as a typical example from which we may gain a good idea of the essential parts of a lichen and their general structure, after which we may more profitably consider the various modifications of these parts which appear in other members of the group.

Fig. 1.
Parmelia conspersa. Natural size.
(After Rabenhorst.)

A cursory examination of our plant shows it to be a mat-like, much-lobed expansion, upon which are borne the conspicuous fruits. The latter are called *apothecia* (Ap., Fig. 2); the main part of the

plant-body is termed the *thallus* (TH., Fig. 2). The thallus increases in size by elongation and repeated branching of the lobes near their tips; hence the older portions are towards the center. From the under side of the thallus are developed numerous projections, called *rhizoids* (RZ., Fig. 2), which serve to attach the plant to the "substrate," or surface upon which it rests. Occasionally, upon the upper surface of the thallus appear little granular or powdery heaps (SD., Fig. 2), called *soredia*. These are sometimes so numerous as to alter considerably the appearance of the lichen. Finally, close scrutiny with the magnifier will bring to view a number of black specks scattered irregularly over the lobes. Each is the mouth of a small cavity, called a *spermagone*, which extends into the body of the thallus (SG., Fig. 2).

If a very thin slice cut across the thallus be examined with a magnifying power of two or three hundred diameters, the structures shown in Fig. 3 are exhibited. The principal mass is composed of delicate tubular threads, called *hyphæ* (H), which are rather loosely interwoven to form an inner or *medullary layer* (M), and firmly compacted toward the surface of the thallus, forming a *cortex* (C) above and below. Just below the upper cortex is an irregular layer composed of innumerable bright green bodies (G) interspersed among the medullary hyphæ. These little bodies are termed *gonidia*. In each we may distinguish a transparent envelope surrounding the green protoplasmic contents. Close examination will show that branches of the medullary filaments are often in intimate contact with the gonidia.

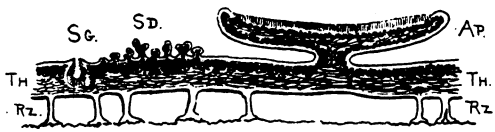


Fig. 2.

The same. Digrammatic vertical section. TH., thallus; RZ., rhizolds: SD., sorendia: AP., apothecium: SG., spermagone. (Original.)

For many years after their discovery it was believed that this close connection indicated that the gonidia were outgrowths from the hyphæ or *vice versa*. In 1869, however, the great German botanist Schwendener showed there were strong reasons for believing that the gonidia are not genetically connected with the hyphæ, but are minute *Algae*, upon and around which had grown the hyphæ of a parasitic fungus; in other words, that a lichen is not a single individual possessing as organs hyphæ and gonidia, but is a community consisting of (1) a host of small *Algae*—such as one finds growing by themselves on trees and rocks—and (2) a fungus, the like of which is also found living separately upon bark, but which in a lichen has become adapted to imprison *Algae* and gain nutriment from them.

Ever since Schwendener's time important evidence has been accumulating to confirm his view, until to-day it appears to be as well proved as Harvey's theory of the circulation of the blood. Without going at length into the details of this evidence, we may cite, in brief, the following facts:

1. All known forms of gonidia have been found to resemble species of *Algae* (belonging to several diverse families) which grow in situation

favorable to their being attacked by lichen-fungi. The only differences between the gonidia and the free *Algae* are such as would naturally follow from their different conditions of life.

2. What the theory considers to be the fungal part of lichens agrees in most important particulars with certain non-lichenous fungi, belonging to three different orders; and while the fungal part of some lichens differs considerably from the other fungi of their order, there are all gradations between these species, and some which cannot be distinguished from non-lichenous forms, except by their growing in contact with gonidia.

3. Gonidia have been separated from lichens and made to grow by themselves, when they exhibit all the characteristics of free *Algae*.

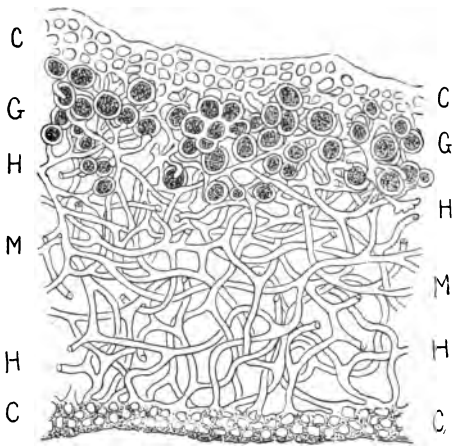


Fig. 3.

The same. Vertical section of thallus, magnified about 250 diameters. H., hyphæ; M., medulla; C. cortex; G., gonidia. (Original.)

4. Lichen-fungi have been made to grow without gonidia, like other fungi, by supplying them with organic food in solution.

5. Lichen-fungi have been made to grow upon free *Algae*, and upon gonidia taken from other species of lichen, and produced a regular lichen-thallus.

6. The hyphal part of certain lichens is for some time entirely without gonidia, and gains its nutriment from bark, like other fungi; later it feeds on *Algae*.

Regarding the function of gonidia, there is but one opinion, namely, that they are the food producers of the little community, and give of their abundance to the hyphæ, which latter in the absence of some such supply of organic material could not live. We may compare the lichen-fungus to a farmer, and the gonidia to his cattle which yield him food, while he in turn shelters them and otherwise provides for their necessities.

There can be no doubt that the gonidia thrive under the conditions imposed upon them, for they multipy so rapidly as to burst through the cortex, thus giving rise to the soredia before mentioned. Each soredium is, in fact, a tiny cluster of gonidia surrounded by hyphæ. When detached and carried by the wind to some moist surface favorably situated, it grows into a lichen the same as that from which it was derived. Soredia are thus little colonies sent out by a parent community. With certain species, especially in certain localities, this is the chief—if not the only—method of reproduction. It will readily be seen how admirably adapted is this method for

securing wide distribution of sorediiferous lichens. Even when no *Algae* are present, as on freshly exposed rock surfaces, soredia may establish themselves.

The apothecia, or proper fruit of our typical lichen, consists essentially (see Fig. 4) of (1) a number of short hyphal branches perpendicular to the surface, and compacted into a dense layer, called the *hymenium* (Hm.), which arises from (2) a denser tangle of hyphæ, termed the *hypothecium* (Hc.). The surface of the hymenium is called the *disk* (Dk.). These parts (in Parmelia) are more or less enveloped by a continuation of the thallus (compare Fig. 2), called the *thalline exciple* (Th. Ex.).

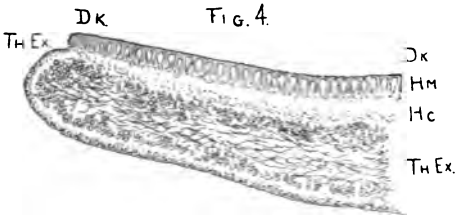
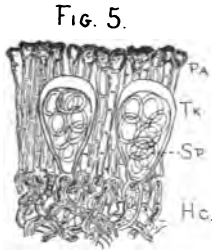


Fig. 4.

The same. Vertical section of apothecium, magnified about 50 diametres. Th., Ex., thalline exciple; Hc., hypothecium; Hm., hymenium: Dk. disk.



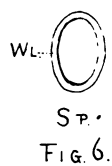


Fig. 5.

The same. A portion of the hymenium, magnified about 350 diametres. Pa., paraphyses; Tk., theka; Sp., spore; Hc., hypothecium.

Fig. 6.

The same. A spore, magnified about 1,000 diametres. Wl., wall. (Original.)

The hyphal branches which compose the hymenium are of two sorts: (1) slender filaments (*paraphyses*, Pa., Fig. 5), each ending at the surface in a colored knob, and (2) club-shaped sacs (*thekes* or *thecæ*, Tk) each of which contains when mature usually eight minute bodies known as *spores* (Sp.) The spores are reproductive bodies, each capable under suitable conditions of growing into a lichen-fungus like the parent. In our Parmelia the spores (Fig. 6) are simple cells, ellipsoid in form, and consist of a delicate transparent wall (Wl.), enclosing gelatinous (protoplasmic) contents which are colorless or but faintly tinged. The paraphyses besides affording some protection to the young thekes during development, aid in the ejection of the spores. Under the influence of moisture the paraphyses swell, and thus press upon the ripe thekes so that the apices are ruptured and the spores squeezed out with considerable force. A melon seed pressed between thumb and finger illustrates well what happens.

Cambridge, Mass.

(To be Continued.)

TORTULA PAGORUM (MILDE) DeNOT.

WILLIAM EDWARD NICHOLSON.

I was interested in the record in the July, 1904, number of THE BRYOLOGIST by Dr. Grout of *Tortula pagorum* from Georgia, and, as shortly after receiving it, in company with Mr. H. N. Dixon, visited Milde's original locality for this species I have thought that a few notes on its occurrence there might not be without interest. I am a little surprised that Dr. Grout should predict a wide and more northern distribution, for this species, since in Europe it has a very limited and southern distribution, being apparently confined to Milde's original locality at Meran in the South Tyrol, where it is found in the same district as *Timmiella anomala* DeNot., *Fabronia octoblepharis* Schwgr., *Thuidium pulchellum* DeNot., *Braunia sciuroides* Bry. Eur. and other southern mosses. It is mostly found on dry exposed rocks and only occasionally on trees. We noticed it principally on a dry vineyard wall in the neighborhood of Algund, a village close to Meran, where it presented a very dusty and dried-up appearance.

In all probability *T. pagorum* is only a specialized form of *T. lævipila* DeNot. adapted to xerophytic conditions and it is connected with the type by the subspecies or variety *T. lævipilæformis* DeNot. This form has a wide distribution in Europe and extends to England. I find it not infrequently in my own neighborhood. Several characters have been predicated of this form as separating it from typical *T. lævipila*, but these seem to be rather unstable, with the exception of that derived from the presence of brood-leaves in the center of the terminal rosettes. These brood-leaves are well described by Prof. Correns in his "Untersuchungen über die Vermehrung der Laubmoose durch Brutorgane und Stecklinge" (p. 85 et seq.) and are most interesting, as they throw light on the origin of the somewhat similar bodies in *T. pagorum*. In *T. lævipilæformis* they are obviously modified leaves. Intermediate stages occur between them and the true leaves, and in fact they never entirely lose their leafy character. In *T. pagorum* the specialization has proceeded much further; their appearance is very different from that of the true leaves and they are much more uniform.

It is probable that *T. lævipilæformis* will also be found in North America, as it probably follows the greater portion of the distribution of *T. laevipila*, though it seems to be rather more frequent in the southern portions of the area inhabited by that species.

In the first volume of his work (Laubmoose, &c., Vol. I. p. 683) Limpricht hazards the suggestion that *T. pagorum* may be a forma *propagulifera* of *T. alpina* Bruch., which is common at Meran, but our observations on the spot did not at all give color to this view, which Limpricht apparently withdrew subsequently, since in his supplemental note on *T. lævipilæformis* (Laubmoose, &c., Vol. III, p. 707) he expressly compares the brood-leaves of this species with those of *T. pagorum*.

Lewes, Sussex, England.

A LONG LOST GENUS TO THE UNITED STATES—ERPODIUM (BRID.) M. C.

By a strange series of accidents and mishaps a rare moss which was collected by W. S. Sullivant in Georgia sixty years ago, and was described by Austin thirty-two years later, has remained in oblivion ever since 1877 and has only been rediscovered in connection with my studies of West Indian mosses! Owing to its resemblance to *Frullania* or *Lejeunia*, it had been sent to Manchester, England, with Austin's Hepatics which were sold to W. H. Pearson. Subsequently it was returned to the Herbarium of Columbia University and placed among the Hepaticæ, where Dr. Howe rediscovered it. Dr. Evans has supplied me with the following references, and the description is drawn from Austin's specimens.

Erpodium biseriatum (Austin) Austin Bot. Gaz. **2**:142, 1877.
Lejeunia biseriata Austin Proc. Acad. Sci. Phila. **21**:225. 1869.

Stem slender, 1 cm. long and about 1 mm. wide. Leaves 0.40–0.50 mm. long, unequal at base, with distinct hexagonal or rounded cells at apex, 0.005 x 0.013 mm. in diameter with thick brown walls, basal and central cells longer and narrower, 0.010 x 0.040 mm., the translucent marginal cells not papillose, dorsal cells with from 4–8 minute papillæ. Fruit unknown.

Collected with *Lejeunia Sullivantii* by W. S. Sullivant, near Augusta, Georgia, in 1845.

Dr. Small tells me that the region around Augusta is very hot and moist, with densely wooded river swamps, where mosses and hepatics abound. This would account for the occurrence of this tropical *genus* within our limits, as its nearest relative *E. Cubense* and *E. Domingense* are in Cuba, Santo Domingo, Porto Rico and Jamaica, with another species, *E. diversifolivm*, in Mexico. Full descriptions of these will be found in the Bulletin of the Torrey Botanical Club for May. ELIZABETH G. BRITTON

NEW OR UNRECORDED MOSSES OF NORTH AMERICA.

BY J. CARDOT AND I. THÉRIOT.

Translated and condensed from The Botanical Gazette, May, 1904.

Descriptions of new species given in full. See BRYOLOGIST, January and March, 1905.

BARTRAMIA ITHYPHYLLA Brid. var. FRAGILIFOLIA Card. & Thér.

Differs from the type in its rigid, fragile, much broken leaves.

Colorado: Along the Cogwheel Railroad to Pike's Peak, alt. 2100–3000m. (J. M. Holzinger, 1896).

By its brittle and usually broken leaves, this form much resembles *B. breviseta* Lindb., but in the latter the leaf base is hardly glossy and less abruptly contracted to the subula.

WEBERA CHLOROCARPA Card. & Thér.

Rather densely caespitose, covered with soil at the base, fuscous green below, above yellowish. Stems 1–2 cm. long, erect, simple or divided.

Leaves erect-appressed, 2 mm. by 1 mm., ovate-lanceolate, acutely acuminate, a little decurrent at base, margins plane and entire, costa 80μ thick below, short excurrent, basal cells quadrate or short-rectangular, subinflated, 40–60μ by 25–40μ, median hexagono-rhomboidal 40 by 18-20μ, four to five rows, marginal cells of the upper two-thirds narrow, linear forming a sort of yellowish margin. Seta reddish, pale above, more or less flexuous, 2–2.5 cm. long; capsule 2–2.5 mm. long by 0.75 mm. wide, pendulous or cernuous, ovate-pyriform, narrowed into a neck equalling the sporangium, pale yellow, plicate with age, scarcely constricted under the mouth, walls soft with numerous superficial stomata, operculum convex, obtusely apiculate, annulus broad. Teeth 0.44 mm. high, formed of 20–25 joints, basal membrane very wide extending more than half the length of the teeth, segments widely open along the keel, cilia one or two more or less elongated, granulose. Spores 18–20μ in diameter. Seemingly dioicous (antheridial buds not seen on fruiting plants). Plate XX.

Nevada: Marlette Lake, Washoe Co., on stream bank (C. F. Baker, 1902).

Resembles in habit *W. gracilis* DeNot., but much stronger, with a very different areolation of broad and short cells. The leaf areolation recall that of the genus *Mniobryum* Limpr., but the stomata of the capsule are superficial and the annulus is quite distinct.

WEBERA DEBATI Card. & Thér.

In loose yellowish-green tufts, with the habit of Philonotis. Stems 1.5–2.5 cm. high, densely radiculose below, tomentose above, with slender erect innovations. Lower leaves rather remote, erect-spreading. upper leaves closer appressed, about 1.3 mm. long by 0.33 mm. broad, lanceolate, acute, not at all decurrent; margins plane throughout, denticulate nearly to base; costa 40μ thick at base, vanishing below the apex; median cells linear, 140–170μ, 28–30μ broad, the lower cells broader and shorter, rectangular or subhexagonal, marginal cells longer, narrowly linear. Other characters unknown. Plate XX.

North America: Alexander Co. (Herb. L. Debat. without name of collector).

This species seems closely connected with *W. annotina* Bruch., from which it is distinguished by the larger size, the habit resembling that of a small Philonotis, the tomentose stems and the leaves plane on the margins.

BRYUM PENDULUM Sch. var. NEVADENSE Card. & Thér.

Differs from the type in the more slender capsule, similar to that of the var. *angustatum* Ren., but larger; in the convex-apiculate operculum, which is not at all conic; and finally in the leaves and costa which are green, not red at base.

Nevada: King's Canon, near Carson, along stream (C. F. Baker, 1902).

BRYUM POLYCLADUM Card. & Thér.

Synoicous, in broad dense tufts, fuscous within, bright green above. Stems short, 3–5 mm. high, branches slender, erect, numerous, arising from below the perichætium. Leaves erect-appressed, crowded, the lower short,

1 m. long, 0.5 m. broad, the median and upper leaves a little larger, 1.5 mm. long, 0.5–0.6 mm. broad, not decurrent at base, ovate or ovate-oblong, short acuminate, narrowly decurrent from base to apex, denticulate above, costa strong, reddish, 60–65μ thick at base, short excurrent in the middle and upper leaves, hardly percurrent in the lower; median and upper cells short-hexagonal, 30–35μ long, 12μ broad, with incrassate walls, marginal cells linear in two or three rows, lower cells larger, laxer, rectangular, 35-50μ long, 12–18μ broad. Capsule oblong, 4–4.5 mm. long, 1–2 mm. broad, nodding or perdulous, neck abruptly contracted when moist; operculum convex-apiculate. Seta elongated, flexuous, reddish, 4–6 cm. long. Annulus broad. Teeth of peristome narrow, pale, reddish above with 18–22 lamellæ, 0.35-0.4 mm. long, 50μ broad at base, basal membrane of the inner peristome adherent $\frac{1}{3}$ the height of the teeth, segments linear, gaping along the keel; cilia very short or none. Spores minute, pale, 12μ in diameter. Plate XXI.

Nevada: Spooner, Douglas Co., in large mats on moist banks (C. F. Baker, 1902).

This moss can be placed near *B. longisetum* Bland., but it is easily distinguished from it by the numerous sterile branches arising from below the perichaetium, the smaller leaves with a shorter acumen, the peristomial teeth, which are narrower and paler, and have more numerous lamellæ, and finally the much smaller spores.

(To be Continued.)

WHAT TO NOTE IN THE MACROSCOPIC STUDY OF LICHENS.

Bruce Fink.

Introductory Statement.

Mrs. Carolyn W. Harris has, in previous volumes of the Bryologist, given amateur lichenists a series of descriptions of the more conspicuous lichen species, which will prove helpful to workers in determinations and in fixing the main features of gross morphology. It is the purpose of the present paper to state the principal features of gross morphology, including not only the foliose and fruticose lichens, but also extending the statement to the most inconspicuous crustose species as well. In so doing, we shall confine attention to such elements of structure as may readily be seen with the unaided eye or with an ordinary hand-lens.

The Thallus.

In this study, it is but natural to begin with the vegetative tract of the lichen—the thallus. The thallus may be an erect structure, rising from the substratum; a pendulous one, hanging downward from it; a conspicuous or inconspicuous flat one, closely or loosely attached to the substratum; or an inconspicuous one, largely or even wholly imbedded in the substratum. Erect and pendulous forms are commonly called fruticose thalli, and the flat or horizontal ones may be either foliose, or crustose; foliose when somewhat leaf-like, and crustose when a closely attached crust resting on or within the substratum.

General Forms of Thalli.

Here we may consider such characters of the three types of thalli as may be readily seen. Beginning with the foliose forms, which the student will be likely to observe first, it will be readily noticed in comparing a number of them that they are variously lobed, or that some are quite entire at the margin. In instances where the lobing is evident, the lobes may be more or less imbricated. In both lobed and unlobed forms the margin may be wavy or crenate instead of entire, and it may be ciliate or devoid of cilia.

Passing to the fruticose thalli, which are quite as likely to attract attention, one would notice first of all whether branched or unbranched, and the manner of branching. Then attention would be attracted to the surface, and one would readily observe that in some there are small outgrowths from the main axes, other than the branches. These are flat expanses in the *Cladonias*, and called squamules. In the *Stereocalons*, these outgrowths are more irregular in form, and are known as phyllocladia.

In the crustose thalli, one would note with the eye, as a rule, simply a more or less conspicuous crust spread over the substratum, or sometimes really lying wholly or partly in the substratum, and indicated at the surface often only by a change in color. These crustose thalli will be found irregular in outline or more or less plainly orbicular, and to form a continuous or more or less broken and scattered crust. In some species the tendency is toward more orbicular forms, and in others more toward irregularity in form; but in any case, the peculiarities of the surface of bark, dead wood or rock forming the substratum will determine the form of the particular thallus to a large extent.

Lichens are a late evolution, and the forms are still quite plastic. Nevertheless, the forms, sizes and colors of lichen species are quite as constant as in many undoubted autonomies, whether plant or animal. Indeed, in many lichens the morphological characters, whether gross or minute, are quite as constant as are those of most flowering plants, and it may well be doubted whether even the *Cladonias* are very much more plastic than the members of the genus *Craetegus*, including our common hawthorns.

Sizes of Thalli.

Having disposed of the matter of forms and positions of lichen thalli, some words are in order regarding sizes. The measurements are all given in this paper in units of the metric system, and fruticose thalli of *Usnea longissima* frequently reach 1.5 metres in length, while the foliose thalli of *Gyrophora Dillenii* sometimes reach .35 of a meter in diameter. To simplify somewhat, strands of the *Usnea* five feet long have been carefully picked out of the tangled masses hanging over the branches of trees, and specimens of the *Gyrophora* and another species of the genus have been measured which surpassed one foot across the longer way of the thallus. Both fruticose and foliose thalli may vary in size from these large forms to minute ones not more than .2 mm. in height or diameter. In the crustose thalli, we most naturally think of the spread over or within the substratum, and this may vary greatly, though the spread is seldom more than 10 cm. In these

and the fruticose forms, the thickness is to be taken into account. But in the descriptions, actual measurements of thickness are very seldom given, though comparative statements are often resorted to. In the descriptions of the fruticose forms the diameter of the thallus, or branches of it are often given; and here again is a considerable amount of variation found, though very much less than that of length or distance across the thalli.

The Surfaces of Thalli.

After noting the size and form of the thallus the observer would naturally turn to the surface and note its general character. First, in the foliose thalli, he would note whether the upper surface is comparatively smooth or wrinkled, corrugate or pustulate; whether it bears cilia or the minute growths known as isidioid branchlets, and whether it is sorediate or not. Also, now, if not before, he must notice whether the margin of the thallus is closely attached to the substratum, or more or less ascendant. Then turning to the lower surface, it will commonly be found that it is more or less covered with the attaching organs known as rhizoids. It must be noticed whether these are large or small, whether numerous or few, and whether evenly scattered or collected into rows or in groups or other forms. Then, too, the lower surface is sometimes quite smooth. except for these rhizoids, but in other instances it will be found to be variously wrinkled or pitted, or in *Gyrophoras*, bearing vertical plates which gives strength.

In the fruticose thalli, one will find the surface smooth or more or less pitted, and in some instances it is somewhat tomentose. Then, in the *Stereocaulons*, one will find the peculiar structure known as phyllocladia, and in the *Cladonias*, the squamules. The form, size, frequency of occurrence and distribution of these organs must be noted carefully. And in the *Cladonias* especially, it is necessary to note whether the cortex of the podetium is entire or more or less broken so that it becomes areolate or even disappears over some portion of the podetium. And in this same genus, careful observation with a lens is necessary to ascertain whether any part of the fruticose portion of the thallus is sorediate or not.

Finally, turning to the crustose thalli, they are also smooth or variously roughened. Those that are hypophloeodal or hypolithic simply take the contour of the surface of the substratum as do also some thin and smooth forms that are in part or wholly epiphloeodal or epilithic. Others are scurfy or granular, and these are usually rather poorly developed and thin. In thicker forms we are likely to find the warty or verrucose condition, and here and there may occur minute chinks, so that the thallus is said to be rimose or chinky, or finally the chinks may become numerous and divide the thallus into minute or small several sided areas known as areoles. Such a thallus is said to be areolate.

Colors of Thalli.

As compared with size and form, color is usually regarded as a rather more variable and therefore less reliable taxonomic character. Yet the colors of thalli play quite an important part in determining lichens, and though often quite variable, they must be carefully noted. Colors in lichen thalli

has shorter stems, more serrate leaves, not twisted when dry and a longer capsule.

BRYUM SUBDREPANOCARPUM Card. & Thér.

Dioicous, loosely caespitose, green. Stems short, 5–7 mm. high, radiculose below, forming slender loosely foliate innovations under the perichaetium. Lower leaves remote, upper crowded into a small rosette, 1–1.5 mm. long, 0.6–0.75 mm. broad, ovate-oblong, short-acuminate; margins longly revolute, plane and denticulate in the upper part; costa 80μ thick at base, vanishing usually below the apex; areolation lax, basal cells rectangular, median and upper oblong-hexagonal, 60μ long, 18–20μ broad, marginal cells 1–2 rows narrow, linear, yellowish. Seta reddish below, pale above. 1.5–2 cm. long. Capsule pendulous or nodding, oblong, arculate, with a long neck; operculum convex-apiculate. Annulus broad. Peristome perfect, cilia appendiculate. Spores 8–12μ thick. Plate XXII.

California: Soldier's Home, Los Angeles Co. (Dr. Hasse, 1902; herb. C. F. Baker).

This moss is very near *B. drepanocarpum* Philib., from which it differs by its shorter and broader leaves, denticulate in the upper part, and forming a small rosette or bud at the top of each stem, and by its costa generally vanishing below the apex.

BRYUM CAMPTOCARPUM Card. & Thér.

Monoicous, rather laxly caespitose, yellowish green. Stems short, about 5 mm. high, radiculose, simple or branching. Leaves erect, quite crowded, oblong-lanceolate, acuminate, middle and upper leaves 2 mm. long, 0.6–0.7 mm. broad, the lower shorter; margins incrassate, plane or barely reflexed below, subdenticulate towards the apex; costa reddish, 80–90μ thick at base, shorter in the lower leaves, longer excurrent in the upper leaves; median and upper cells hexagonal and rhomboidal, 54–70μ long, 18–24μ broad, basal cells rectangular, 80–90μ long, 20–30μ broad, marginal cells bi- or tri-stratose, forming a beautiful distinct yellowish incrassate border. Male flower on a separate terminal branch. Capsule nodding, oblong, arcuate, 4–4.5 mm. long, 1 mm. broad, tapering into a neck as long as the sporangium; operculum convex, short apiculate. Seta reddish, 1.5–3 cm. long. Annulus double and triple. Peristome perfect, 0.48 mm. high; membrane of the inner peristome extending more than half the height of the teeth; processes narrowly gaping for a short distance along the keel; cilia 1–3, appendiculate. Spores papillose, 24μ in diameter. Plate XXII.

Newfoundland: John's Beach, wet places (Rev. Arthur C. Waghorne, 1895).

Allied to *B. meesoides* Kindb., *B. drepanocarpum* Philib., and *B. subdrepanocarpum* Card. & Thér. by the form of the capsule, but distinct from these species by the monoicous inflorescence and by the leaves plane on the margins, or nearly so, with a very distinct and thickened border. It also much resembles *B. pallens* Sw. var. *arcuatum* Sch., from which, however, it differs by the shorter leaves, with margins plane or scarcely reflexed at base and denticulate or sinuate at apex.

(To be Continued.)

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THE BRYOLOGIST

AN ILLUSTRATED BIMONTHLY DEVOTED TO

NORTH AMERICAN MOSSES

HEPATICS AND LICHENS

EDITORS:

ABEL JOEL GROUT and ANNIE MORRILL SMITH

CONTENTS

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